What this means in so far as neutron reactions are concerned is that (n, γ) reactions will involve energies of the order of 8 Mev. The only stable isotopes which will not bind a neutron are He^4 and the neutron itself. Of course, any unstable isotope with excess neutrons will not bind a neutron. In fact, referring to Figure 12, the region above the beta emitters might be described as "these nuclei will not bind neutrons" and that region below positron emitters as "these nuclei will not bind protons." Examples of nuclei in the upper region, that is, neutron emitters, are found among the nuclei formed as the result of fission.

It should be pointed out that this 8 Mev rule for (n,γ) reactions is just a rough average and that, particularly for light elements, the value may differ from this average. For example, the opposite process or (γ,n) reaction occurs in the case of deuterium (see Chapter I) at a threshold of 2.2 Mev and in the case of beryllium at 1.7 Mev, showing that the neutron binding energies can differ considerably from 8 Mev.

PROBLEMS

1. Find five examples of each of (n,γ), (n,p), (n,α) and (n,2n) processes. Record the half-lives of any radioactive product nuclei.

2. Calculate the binding energy of a neutron to each of the following nuclei: H^1, H^2, Li^6, Li^7, Be^9, B^{10}, B^{11}, C^{12}, C^{13}.

3. Calculate the packing fraction and average binding energy of a neutron (or proton) in the neighborhood of iron.

4. Write the equation for the transformation of a proton into a neutron (plus other particles). What is the Q value?

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